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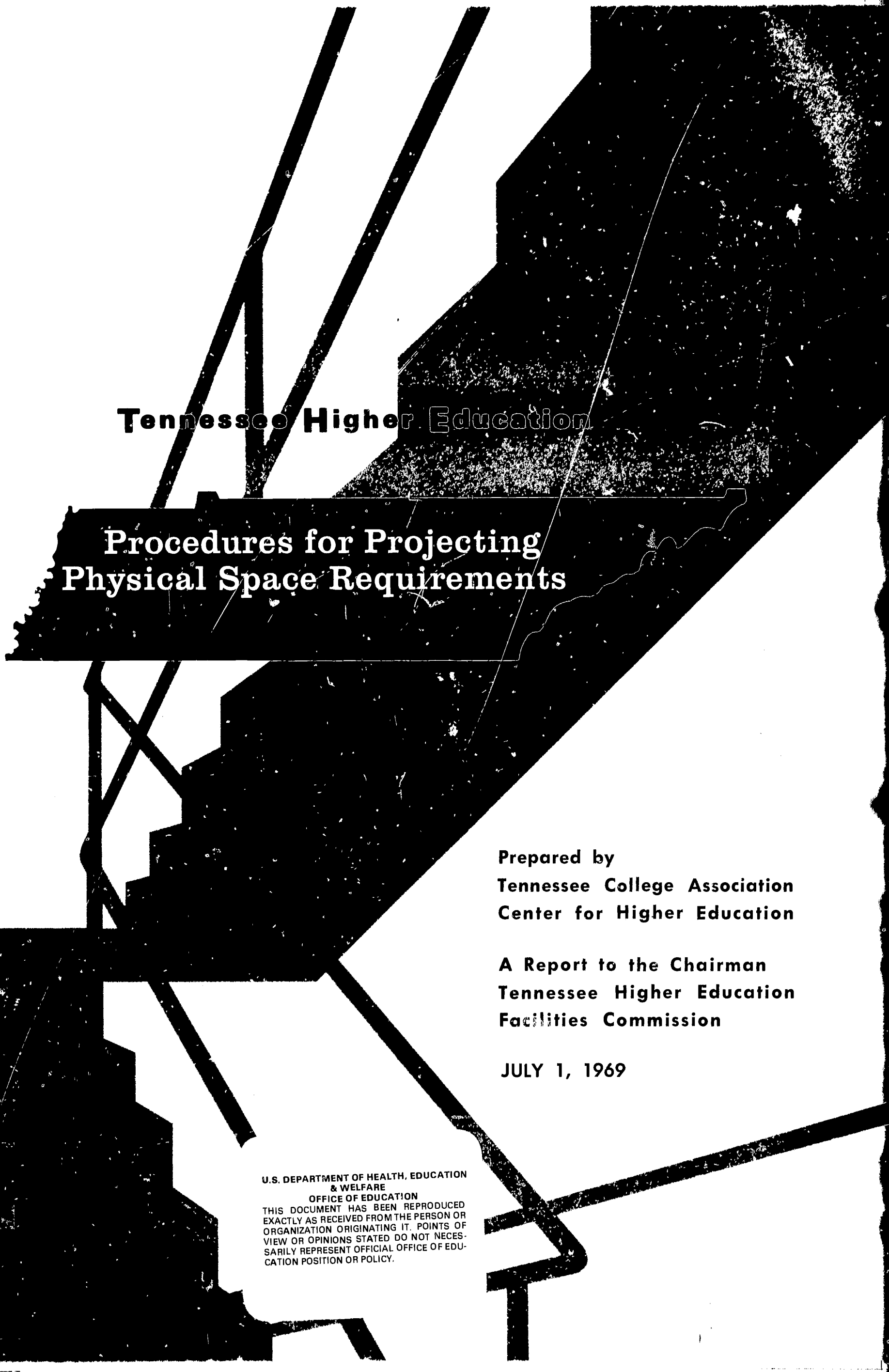
ABSTRACT

A broad description is presented of both the simulation and formula methods of projecting future space requirements for Tennessee higher education. The report then focuses on a detailed analysis of the use of the formula method. Four institutions are described both quantitatively and qualitatively and are used to illustrate the formula-based method. Some recommendations are made concerning the method for future space projections in Tennessee higher education. A brief bibliography is included. (FS)



Tennessee Higher Education

Procedures for Projecting Physical Space Requirements

Prepared by
Tennessee College Association
Center for Higher Education

A Report to the Chairman
Tennessee Higher Education
Facilities Commission

JULY 1, 1969

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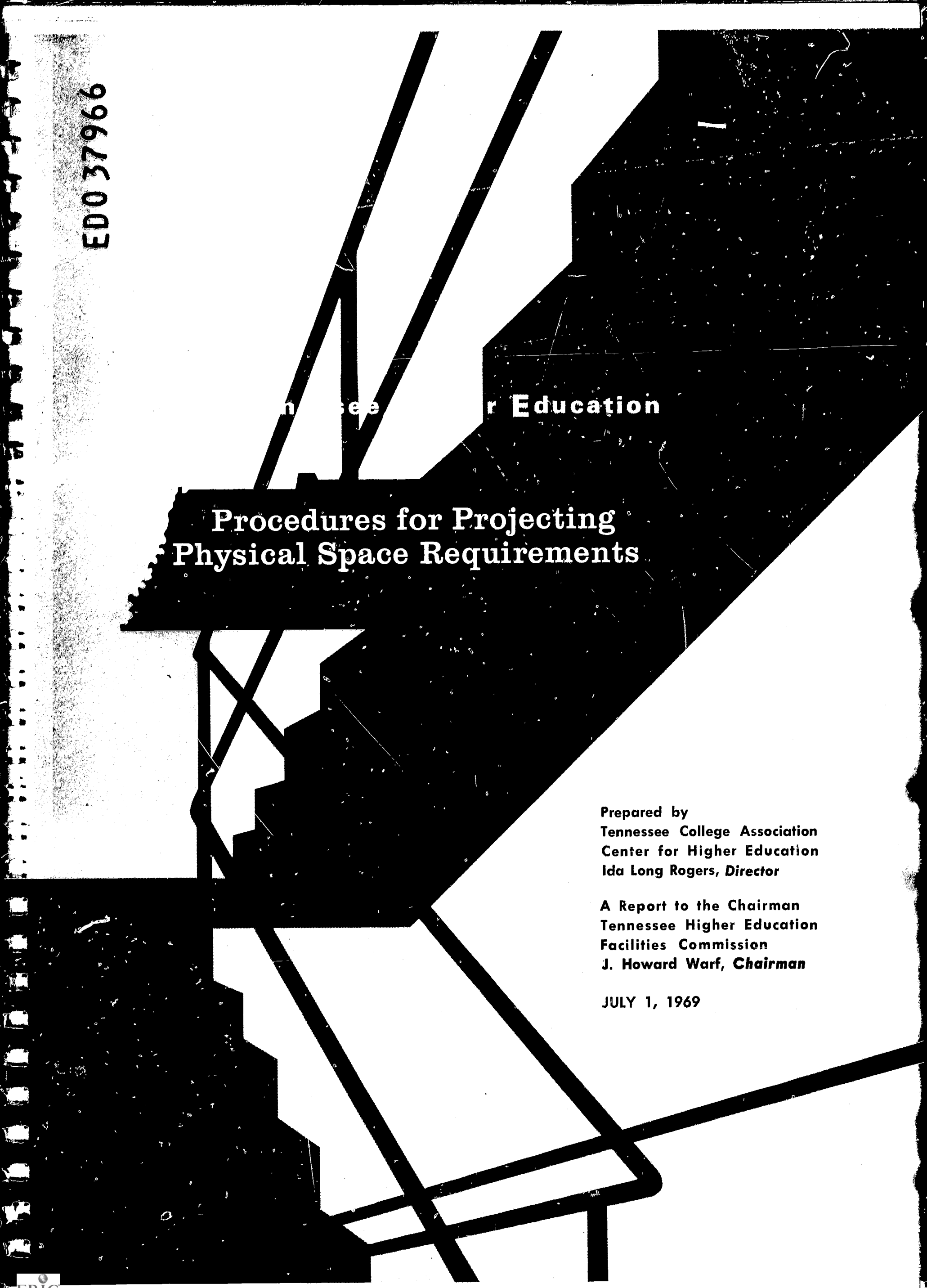

Procedures for Projecting Physical Space Requirements

Prepared by
Tennessee College Association
Center for Higher Education
Ida Long Rogers, *Director*

A Report to the Chairman
Tennessee Higher Education
Facilities Commission
J. Howard Warf, ***Chairman***

JULY 1, 1969

FOREWORD

The By-Laws of the Tennessee College Association establish that the first purpose of the Center for Higher Education "Shall be to promote cooperation and planning of the participating institutions toward the most effective use of their educational facilities, personnel and other resources in meeting the needs of higher education in Tennessee." A further purpose is "to conduct surveys, studies and research in higher education on behalf of participating institutions."

Consistent with these purposes and the philosophy of the Association, this is one in a series of reports prepared by the TCA Center for Higher Education for the Tennessee Higher Education Facilities Commission. The study staff would express again their appreciation and respect for the professional concern evidenced by the institutions already burdened with requests for information and demands on limited staffs and budgets.

The continued opportunity to work with the Chairman of the Higher Education Facilities Commission, J. Howard Warf, and the Executive Secretary of the Commission, George M. Roberts, was gratifying as they provided direction, support and a high level of understanding throughout the study.

Ida Long Rogers

Director

TCA Center for Higher Education

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INTRODUCTION

Planning for physical space has always been a part of the decision-making process in higher education.[1] Until the present leveling of enrollment, it has by force of circumstance been difficult to seriously pursue. Burdened with a responsibility to accommodate many more students than it had anticipated, higher education was until very recently building to meet the previous year's enrollment demands. All one need do is recall the flood of students which grew from a burgeoning post-war population. Although ready to cope with the predicted average percentage of total available student population, established on the basis of past percentages, the college and university was quite unprepared for the disproportionate number beyond that percentage who came. Higher educational institutions were caught in a dilemma somewhat similar to that of a husband and father, who anticipating his family's growth in a normal fashion, built a two-bedroom house only to find himself the father of triplets. In "impulse-buying" fashion the men responsible for the physical plant in higher education were forced to add on, build anew, and renovate with little time to consider the needs of the 70's and 80's. With previous plans totally inadequate and little or no time to analyze future needs, building went on at a pace just a little behind student enrollments. That this period of volatile student growth has ended generally is well documented by recent Office of Education publi-

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[1] Dean E. McHenry, "Planning in the College or University," Long Range Planning in Higher Education, ed. Owen A. Knorr, WICHE (Boulder Colorado: 1965), p. 7.

cations. Both the Siegal[2] projections and the Simon and Fullam[3] projections provide evidence of this. It is no longer feasible or appropriate to build without a specific look at the present allocation of resources and the future demand on those resources.[4] Faced with a student enrollment plateau, space planners in higher education must now concern themselves with many problems that in the past were of little concern. That there will be future enrollment growth is undeniable; that that growth will be more moderate and constant has already been discussed.[5] Educational space planners must concern themselves with justification for further needs. They must justify specific needs rather than broad requirements.[6] It is to that end that this report addresses itself.

It is the purpose of this report to discuss both broadly and in detail the methods available for projecting the future space requirements for higher education. Some recommendations, in the light of current circumstances, will be made concerning a method for future space projections. It was felt appropriate, both by the author of

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[2]Jacob S. Siegal, "Revised Projections of School and College Enrollment in the United States to 1985," Current Population Reports: Population Estimates. Series P-25, No. 365 (May 5, 1967) Bureau of Census, U. S. Department of Commerce (Washington: U. S. Government Printing Office).

[3]Kenneth A. Simon and Marie G. Fullam, Projections of Educational Statistics to 1976-77, Office of Education, U. S. Department of Health, Education and Welfare, OE-10030-67 (Washington: U. S. Government Printing Office, 1968).

[4]Planning Facilities for Higher Education, National Council on Schoolhouse Construction, (East Lansing, Michigan, 1960), p. 5.

[5]Jacob S. Siegal.

[6]H. L. Wilsey, "Long Range Planning for Colleges and Universities," Speech on the occasion of College Public Relations Week, 1962.

this report and the Tennessee Higher Education Facilities Commission, to submit a report of this nature prior to actually projecting the space needs of higher education in Tennessee. This, to allow time to consider the options for determining future space needs. Too often in the past, for reasons varied in nature, institutions have applied methods either inappropriate or too unrefined for determining future space needs. This report represents a working paper, providing a basis for the discussion, evaluation and refinement of space projection procedures. Not only must each institution consider carefully these procedures but those people directly affected, namely space users, must be involved in these discussions. There are presently two general methods discussed when considering procedures for determining future physical plant needs for institutions of higher education. They are simulation and formula. The specific focus of this report will be on the use of formula, less because of the inadequacy of the other method than with the fact that more data is available for formula based projection than available for simulation.

METHODOLOGY

Given the nature and purpose of this report as previously stated, the following manner of proceeding seemed appropriate. It was decided to investigate in detail the formula-based method thus providing a more extensive basis for review and evaluation. Consistent with this aim, published reports from other institutions and statewide systems were solicited and received.[7] In addition, research in the literature available in this area was reviewed to determine current methods and to examine future methods, such as simulation. Having chosen to

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[7]See Appendix A.

discuss in depth the formula-based method, it remained to devise an explication procedure that would be at once broad enough in scope and narrow enough in detail to allow a comprehensive evaluation. It was decided to describe four institutions both quantitatively and qualitatively and to use fictional data about these institutions in the formulas. This allows both the investigator and the reader to analyze more accurately the precise effect the use of formulas will produce. The following pages contain descriptions of each institution. If the descriptions appear brief they are so by design since this allows for a wider range of comment and also for additional subjective interpretation by the reader. Through this subjective interpretation it is hoped the reader will be able to perceive and discuss how adequately a formula-based methodology will reflect institutional uniqueness.

INSTITUTION A

This institution is a private sectarian undergraduate four-year liberal arts college. Its campus is relatively small allowing for easy and quick student movement from one part of the campus to another. Most of its students reflect the average socio-economic standing of the nations students and live in the college's residence halls. The present emphasis of the academic program is the development of Christian leaders through a curriculum with heavy emphasis on the liberal arts. With a physical plant which is in good condition the college plans no significant shifts in either its curricular program or its present objectives. However, in spite of the above mentioned objectives, the institution could involve itself to a greater intent in a more science-oriented curriculum.

INSTITUTION A

Classrooms (Room Type, 100)*		28,837
Room Type - 110 (Regularly Scheduled)		
Square Feet	28,837	
WSCH (Weekly Student Contact Hours)	25,667	
No. of Student Stations	1,981	
Laboratories (Room Type, 200)		16,246
Room Type - 210 (Regularly Scheduled)		
Square Feet	8,439	
WSCH (Weekly Student Contact Hours)	2,075	
No. of Student Stations	421	
Office (Room Type, 300)		36,342
Library (Room Type, 400)		14,763
Special Use (Room Type, 500)		42,640
General Use (Room Type, 600)		57,428
Supporting (Room Type, 700)		5,350
Residential (Room Type, 900)		181,612
Non-Assignable (Room Type, 000)		110,382
Un-Assigned (Room Type, 080)		—
Net		487,600
Gross		535,780
FTE (Full-Time Equivalent) Staff	20	
FTE (Full-Time Equivalent) Faculty	90	
FTE (Full-Time Equivalent) Student	1,750	
1975		
FTE (Full-Time Equivalent) Staff	25	
FTE (Full-Time Equivalent) Faculty	105	
FTE (Full-Time Equivalent) Student	2,000	
1980		
FTE (Full-Time Equivalent) Staff	35	
FTE (Full-Time Equivalent) Faculty	131	
FTE (Full-Time Equivalent) Student	2,500	

*Room type classification numbers based on Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

INSTITUTION B

This institution is a public community college serving a rural area with a history of relatively low socio-economic conditions. It is a new institution and has few facilities presently but with much usable land for growth. There is currently no on-campus housing for students and none is anticipated. Most of its current student population is enrolled in academic programs; there is much evidence in the future at least half of its student body will be enrolled in technical-vocational programs. Less than half of its students are full-time, the majority attend school on a part-time basis at increasingly irregularly scheduled hours. Although the present students are in academic programs and there is strong indication that more technical-vocational programs will be developed; there are also plans to offer many special programs as a service to the community it serves. This suggests a future condition necessitating a high degree of flexibility both in program and schedule.

INSTITUTION B

Classrooms (Room Type, 100)*		7,575
Room Type - 110 (Regularly Scheduled)		
Square Feet	7,575	
WSCH (Weekly Student Contact Hours)	8,245	
No. of Student Stations	399	
Laboratories (Room Type, 200)		16,855
Room Type - 210 (Regularly Scheduled)		
Square Feet	12,668	
WSCH (Weekly Student Contact Hours)	2,828	
No. of Student Stations	342	
Office (Room Type, 300)		14,181
Library (Room Type, 400)		4,960
Special Use (Room Type, 500)		720
General Use (Room Type, 600)		6,874
Supporting (Room Type, 700)		717
Residential (Room Type, 900)		—
Non-Assignable (Room Type, 000)		20,924
Un-Assigned (Room Type, 080)		—
Net		72,806
Gross		82,866
FTE (Full-Time Equivalent) Staff	20	
FTE (Full-Time Equivalent) Faculty	70	
FTE (Full-Time Equivalent) Student	1,100	
1975		
FTE (Full-Time Equivalent) Staff	25	
FTE (Full-Time Equivalent) Faculty	116	
FTE (Full-Time Equivalent) Student	1,750	
1980		
FTE (Full-Time Equivalent) Staff	38	
FTE (Full-Time Equivalent) Faculty	146	
FTE (Full-Time Equivalent) Student	2,200	

*Room type classification numbers based on Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

INSTITUTION C

This institution is located in a densely populated urban area. Although it has reason to anticipate doubling its enrollment over the next ten-year period it has limited space in which to develop its physical facilities. It has a developmental history of changes in its nature and function occurring for many valid reasons. There is every reason to believe that in the future the scope of the institution's programs will change to a significant degree. This will be particularly evident in an extended and extensive emphasis in the future on service and research activities. Because of a growing emphasis on graduate programs at the doctoral level, there is a recognized need to reduce the faculty-student ratio. This is a multi-purpose university serving a variety of student needs. Its present programs are advancing and growing at a very rapid pace, while new programs necessary to the area it serves must be anticipated and inaugurated.

INSTITUTION C

Classrooms (Room Type, 100)*		254,977
Room Type - 110 (Regularly Scheduled)		
Square Feet	254,977	
WSCH (Weekly Student Contact Hours)	155,360	
No. of Student Stations	15,348	
Laboratories (Room Type, 200)		144,621
Room Type - 210 (Regularly Scheduled)		
Square Feet	118,297	
WSCH (Weekly Student Contact Hours)	24,156	
No. of Student Stations	2,461	
Office (Room Type, 300)		169,060
Library (Room Type, 400)		70,857
Special Use (Room Type, 500)		176,712
General Use (Room Type, 600)		136,562
Supporting (Room Type, 700)		12,229
Residential (Room Type, 900)		527,944
Non-Assignable (Room Type, 000)		424,023
Un-Assigned (Room Type, 080)		6,417
Net		1,923,402
Gross		2,186,080
FTE (Full-Time Equivalent) Staff	200	
FTE (Full-Time Equivalent) Faculty	740	
FTE (Full-Time Equivalent) Student	13,900	
1975		
FTE (Full-Time Equivalent) Staff	350	
FTE (Full-Time Equivalent) Faculty	1,293	
FTE (Full-Time Equivalent) Student	24,584	
1980		
FTE (Full-Time Equivalent) Staff	375	
FTE (Full-Time Equivalent) Faculty	1,315	
FTE (Full-Time Equivalent) Student	25,000	

*Room type classification numbers based on Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

INSTITUTION D

This is a public institution with programs leading to degrees on all levels except the doctoral. It is located in a middle-sized urban community. While its campus has experienced, over the last ten years, a phenomenal growth rate, it is rather spread out and still has a relatively free land expansion area. Although in the past, its students have come from within a specified geographic area there is a larger geographic source for its student body. As with many other institutions, this institution's plans include expanding all of its programs; academic, public service and research.

INSTITUTION D

Classrooms (Room Type, 100)*		84,786
Room Type - 110 (Regularly Scheduled)		
Square Feet	84,783	
WSCH (Weekly Student Contact Hours)	78,499	
No. of Student Stations	5,418	
Laboratories (Room Type, 200)		93,338
Room Type - 210 (Regularly Scheduled)		
Square Feet	82,303	
WSCH (Weekly Student Contact Hours)	17,544	
No. of Student Stations	1,249	
Office (Room Type, 300)		84,697
Library (Room Type, 400)		32,803
Special Use (Room Type, 500)		125,349
General Use (Room Type, 600)		99,854
Supporting (Room Type, 700)		32,681
Residential (Room Type, 900)		341,015
Non-Assignable (Room Type, 000)		264,761
Un-Assigned (Room Type, 080)		23,579
Net		1,182,863
Gross		1,332,598

FTE (Full-Time Equivalent) Staff	90
FTE (Full-Time Equivalent) Faculty	350
FTE (Full-Time Equivalent) Student	6,265
1975	
FTE (Full-Time Equivalent) Staff	110
FTE (Full-Time Equivalent) Faculty	466
FTE (Full-Time Equivalent) Student	8,391
1980	
FTE (Full-Time Equivalent) Staff	130
FTE (Full-Time Equivalent) Faculty	529
FTE (Full-Time Equivalent) Student	9,533

*Room type classification numbers based on Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

TOTAL OF ALL INSTITUTIONS

Classrooms (Room Type, 100)*		376,175
Room Type - 110 (Regularly Scheduled)		
Square Feet	376,175	
WSCH (Weekly Student Contact Hours)	267,771	
No. of Student Stations	23,146	
Laboratories (Room Type, 200)		271,060
Room Type - 210 (Regularly Scheduled)		
Square Feet	221,707	
WSCH (Weekly Student Contact Hours)	46,603	
No. of Student Stations	4,473	
Office (Room Type, 300)		304,280
Library (Room Type, 400)		123,383
Special Use (Room Type, 500)		345,421
General Use (Room Type, 600)		300,718
Supporting (Room Type, 700)		1,049,571
Residential (Room Type, 900)		50,977
Non-Assignable (Room Type, 000)		820,090
Un-Assigned (Room Type, 080)		29,996
Net		3,666,671
Gross		4,136,324

FTE (Full-Time Equivalent) Staff	330
FTE (Full-Time Equivalent) Faculty	1,250
FTE (Full-Time Equivalent) Student	23,015

1975

FTE (Full-Time Equivalent) Staff	510
FTE (Full-Time Equivalent) Faculty	1,980
FTE (Full-Time Equivalent) Student	36,725

1980

FTE (Full-Time Equivalent) Staff	578
FTE (Full-Time Equivalent) Faculty	2,121
FTE (Full-Time Equivalent) Student	39,233

*Room type classification numbers based on Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

This report, then, will review specifically the use of formulas in determining future space requirements. For the purpose of clarity and exemplification it will use the information and data of these fictional institutions and the aggregate data in applying the formulas. It is hoped that the reader will remember that the application of the formula does not preclude other methods for projecting building and/or space needs but will allow the kind of review and evaluation this report is concerned with providing.

In addition to fictional institutions, since this report is concerned with projection problems as they relate specifically to Tennessee higher education, two other previous Tennessee reports are relevant. The first is the Tennessee College Association Physical Facilities Inventory-Utilization Study. This study was a descriptive report of types of space available to all institutions of higher education in Tennessee as of the fall of 1967. The second is a study conducted by Ormond C. Corry, Enrollment Projections to 1980 for Tennessee Public Universities and an Increased Number of State Community Colleges and made at the request of the Tennessee Higher Education Commission in 1968. Both of these studies provide information essential for the use of a formula based methodology. The introduction of these studies serve, also, as an appropriate reminder that, at least at present for the state of Tennessee, there is insufficient basic data available to develop and apply a comprehensive simulation methodology. However, the combined information of the two reports, if reviewed and up-dated, will allow the use of a formula method. The major portion of this report is committed to: (1) a discussion of various formulas used to project future space needs, (2) the application of the fictional institutional data to those various formulas, (3) a discussion of the results of that application, and (4) the recommendations suggested by the report.

S E C T I O N I

This section serves to introduce both simulation and formula-based space projection procedures. It includes comments on the general advantages and disadvantages of both processes. Finally, this section provides discussion of the requisites and use of formula-based procedures with examples of broadly defined space projection procedures.

SIMULATION

Currently, the use of simulation is a much discussed methodology for projecting many different elements in higher education. Briefly, its effectiveness is directly related to computer hardware and software availability, accurate definitions, and more importantly to a thorough basic data system of information about either a single institution or a statewide system.[8] In the first instance simulation relies on the computer to provide storage and retrival of data and to project the data into the future. By changing various factors of the basic data and making certain assumptions the computer is able to describe, given those assumptions, conditions at a future point of time.[9] Of the three general requisites for the effective use of simulation, the computer, or hardware, is currently the only requirement that is available. Hardware is available to work with both the data and assumptions. What is lacking in varying degrees, is a sufficient amount of basic data and a test for the reliability and validity of the assumptions needed for effective simulation. A great amount of valid and reliable descriptive information about such elements in higher education as students, faculty, staff, physical facilities, fiscal policy, etc. is necessary. Insofar as descriptive information is lacking about these elements, to that degree the use of simulation will be limited, inaccurately reflecting the future environment of an institution. A person using simulation

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[8]Robert G. Cope, "Simulation Models Should Replace Formulas for State Budget Requests," College and University Business, Vol. 46 (March, 1969), p. 34.

[9]Paul J. Ansfield, "A 'What If' Approach to Academic Facilities Utilization," Proceedings of Statewide Higher Education Conference, Wisconsin Coordinating Council for Higher Education, 1968, p. 217.

must always keep in mind the assumptions about the institution's future state on which simulation is made.[10] This is extremely important since it is often those assumptions which constitute the unique qualities of an institution and make comparisons within and among institutions difficult. In addition to the above prerequisites for using simulation, there is a problem of finance to consider. The use of simulation, as already stated, requires a good deal of both hardware and software. This means an initial investment of substantial amounts of money. While many institutions and systems cannot now make use of this method, they are building on a piecemeal basis the kind of information system that eventually will fulfill the requirements for simulation. Simulation may be an extremely useful means of projecting many kinds of future needs since by using the computer it is able to process and reflect the many, many variables involved in planning in higher education. There are, however, the problems of limited basic information and arbitrary and tentative assumptions which make present use questionable in the light of the initial expenses involved.

FORMULA METHOD

A formula-based method while not as flexible as simulation has the present advantage of using a limited amount of basic information. Admittedly this advantage also has inherent in it some serious limitations insofar as projecting future physical space needs is concerned. As revealed in Appendix B, many state systems of higher education currently are using this method. The justification for its use, however, cannot be the number of schools or systems which use it. Justification for this methodology must be based on other factors. First, current

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[10]Edwin D. Etherington and Richard F. Vancil, "Systems and Simulation: New Technology Goes to Work on Decision-Making," College and University Business, Vol. 46, (March, 1969), p. 60.

justification for the use of this method lies in the fact that the information needed is available though not always collected. Second, since the figures in the formula are quantitative, they allow for continual verification as to reliability and validity. Third, formulas can be and have been refined for both broad and specific categories of space. Although numbers of users cannot be a criterion for judgment, the fact that formula use is and has been evaluated by many groups lends credibility to its admittedly limited effectiveness.

In recalling what has been said previously, it is well to remember that both the formula method and the simulation method presume that the various data used are well defined, when, in fact, they may not be. It is just this point which makes use of either method difficult.

For the purposes of this report, the definitions of space will be based on the Higher Education Facilities Classification and Inventory Procedures Manual.[11] A word about another highly volatile variable in facilities projections is appropriate at the outset. L. J. Lins in his Methodology of Enrollment Projections for Colleges and Universities suggests a number of difficulties and problems attendent on enrollment projections for individual institutions and states.[12] These problems are very relevant to any discussion of facilities needs because all methodologies both as broadly described and as specifically defined depend on an accurate knowledge of the number of students to be served. Therefore, ultimately space projections which depend on student pro-

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[11]Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

[12]L. J. Lins, Methodology of Enrollment Projections for Colleges and Universities (Wisconsin: University of Wisconsin Press, 1960), pp. 2-4.

jections by type and level must be clearly understood as limited by the validity of enrollment projections. Beyond consideration of enrollment, anyone attempting to specify future needs must command some knowledge of the educational, research and service goals and needs of a particular institution and of the state as a whole.[13] For, along with enrollment, these three factors must influence, if not the size, at least the type of facilities needed to meet the demands of the future.

Finally, since the educational environment is a social system, it cannot be fully quantified; at least, not by current available measures. It is important, therefore, in planning future space requirements to keep this fact in mind. Equally important is the need for a sound and equitable basis for allocation of resources.[14] And for that reason, the use of a definable, if limited, method is imperative.

While the use of a formula-based methodology has been generally described further detailed comments on that method need mention. Just as there are more or less sophisticated general methods for projecting physical space needs, within any of them, there are more or less refined procedures. And so with a formula-based procedure there are degrees of complexity and precision. In addition, the formula methodology appropriate for institutional projections may not be necessary or appropriate for broad statewide projections. It is both important and necessary that any set of projections be described in terms of the assumptions

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[13]William T. Middlebrook, How to Estimate the Building Needs of a College or University (Minneapolis: University of Minnesota Press, 1958), p. 3.

[14]Harry Williams, Planning for Effective Resource Allocation in Universities, American Council on Education, (Washington, D. C., 1966).

underlying the particular formula. A projection by an institution of its future space needs may assume a balanced enrollment in all educational programs, an assumption which may or may not be true in fact.[15] The intent, as suggested, is not to project space needs but in fact to consider procedures within the formula method and to discuss the problems involved in the use of those formulas as well as the assumptions which underlie them.

Before going into specific limitations imposed by the information used in formula-based projections, it is well to repeat and expand discussion of the previously mentioned limitations on the formula method in general. As Russell and Doi suggest formulas can only be rough guides to existing quantitative relationships and do not recognize even subtle variations that exist among areas of study. Aside from their superficial validity they can only serve as norms.[16] One of the difficulties in applying formulas, is the resulting tendencies to make their use rigid and inflexibility. Besides these reservations, the method also involves the need for some specific data.

The use of formula in projecting space needs involves the gathering of a certain amount of basic data prior to the application of any formula which is used to determine future physical facilities space needs. Space needs can be determined in terms of the load that a particular space must serve. This suggests that some standards be established for the allocations of various kinds of space. How much space is to be allocated to

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[15]Middlebrook, p. 4.

[16]John Dale Russell and James Doi, Manual for Studies in Space Utilization in Colleges and Universities (Athens, Ohio: Ohio University Press, 1957).

a particular group or item, faculty member office or library volume? The method of arriving at the standard varies considerably, allowing for much flexibility in determining the amount of space to be allocated. It most often is derived from the current inventory of space and the average amount that is now available to each unit in the institution, as shown by the inventory. It may be appropriate to consider the utilization level of certain kinds of space in an institution; this is particularly true as it relates to classroom and laboratory space. In the setting of any standards or minimal levels of utilization to be met, the primary consideration must be to allow for flexibility. No projections of space requirements should limit creative educational programs. It is important that both the standards and levels of utilization be evaluated, not only in terms of the present use of that space, but in terms of the educational goals and needs of an institution or the entire state.[17]

It has been suggested that prior to determining space needs by whatever method, it is necessary to have current information about space available. It is generally agreed, as discussed, that it is necessary to consider future student enrollment, since in one way or another the requirements of the future relate either directly or indirectly to the present and future student load.[18] Since educational programs vary in their space needs, it is important to specify as much as is possible within the limits of current valid and reliable methodology the future

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[17]Harlan D. Bareither and Jerry L. Schillinger, University Space Planning (Urbana, Illinois: University of Illinois Press, 1968), p. 2.

[18]Middlebrook, p. 6.

student population by type and level. An institution or a state should try to determine how many students, for the undergraduate, master's, and doctoral level will be enrolled in each of the diverse educational programs available in an institution or state.[19] As previously mentioned, there are degrees of complexity even within a formula-based methodology. For short range projections very detailed information about the future student may be needed; long range projections might more appropriately be based on more gross factors, such as square feet per full-time or headcount student.

GROSS FORMULA APPLICATION

It should be kept in mind that the use of gross factors does not preclude the necessity of determining in advance, as much as is possible, the validity and reliability of the elements of the formula. Use of the current average gross square feet per student must be based on evidence that that average will be adequate to future needs. For instance, present technology may require more and larger mechanical space, which in turn will affect the space available for other needs. This suggests immediately the use of net assignable square feet rather than gross square feet as a better indicator for future space requirements related to student projections. This approach, while it may more adequately reflect future needs of usable space, does raise the problem of conversion to gross square feet for capital outlay determinations. As mentioned earlier, student projections are vital to planning. Just as significant, must be the definition of the student projected. The use of headcount,

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[19] James F. Blakesley, Capital Requirements Study (West Lafayette, Indiana, Purdue University Press, 1964).

number of persons attending any number of courses, can be deceptive in planning. More appropriate for these two procedures might be a determination of the full-time equivalent students. This means that the planner must concern himself with determining not just number of persons but also with converting part-time students into full-time equivalents. Again all this is done in an attempt to more accurately determine the real future space needs of the institution. It should be remembered that both of these procedures are gross by design. Their usefulness is not in determining specific space needs but broad long range needs. The figure they yield will give no indication of the type of space needed and the figure is limited in that as well as other respects.

To exemplify the application of the preceding formulas, use will be made of our fictional institutions. Using the projected full-time student equivalent enrollments for the years given, by multiplying this figure times the average gross square feet per student and average net assignable square feet, it is possible to show the future needs for the benchmark years of 1975-1976 and 1980-1981.

INSTITUTION A

	1975-1976	1980-1981
Present Average GSF (Gross Square Feet)	306	306
Present Students FTE (Full-Time Equivalent) - 1,750		
Projected Students FTE (Full-Time Equivalent)	x 2,000	x 2,500
	612,000	765,000
Present GSF (Gross Square Feet)	535,780	535,780
Anticipated needs in gross square feet	76,220	229,220

Average NASF (Net Assignable Square Feet)	278	278
Projected Students FTE (Full-Time Equivalent)	x 2,000	x 2,500
	556,000	695,000
Present NASF (Net Assignable Square Feet)	487,600	487,600
Anticipated needs in net assignable square feet	68,400	207,400

INSTITUTION B

	1975-1976	1980-1981
Present Average GSF (Gross Square Feet)	75	75
Present Students FTE (Full-Time Equivalent) - 1,100		
Projected Students FTE (Full-Time Equivalent)	x 1,750	x 2,200
	131,250	165,000
Present GSF (Gross Square Feet)	82,866	82,866
Anticipated needs in gross square feet	48,384	82,134
Average NASF (Net Assignable Square Feet)	66	66
Projected Students FTE (Full-Time Equivalent)	x 1,750	x 2,200
	115,500	145,200
Present NASF (Net Assignable Square Feet)	72,806	72,806
Anticipated needs in net assignable square feet	42,964	72,394

INSTITUTION C

	1975-1976	1980-1981
Present Average GSF (Gross Square Feet	157	157
Present Students FTE (Full-Time Equivalent) - 13,900		
Projected Students FTE (Full-Time Equivalent)	x 24,584	x 25,000
	3,859,688	3,925,000
Present GSF (Gross Square Feet)	2,186,080	2,186,080
Anticipated needs in gross square feet	1,673,608	1,738,920
Average NASF (Net Assignable Square Feet)	138	138
Projected Students FTE (Full-Time Equivalent)	x 24,584	x 25,000
	3,392,592	3,450,000
Present NASF (Net Assignable Square Feet)	1,923,402	1,923,402
Anticipated needs in net assignable square feet	1,469,190	1,526,598

INSTITUTION D

	1975-1976	1980-1981
Present Average GSF (Gross Square Feet)	212	212
Present Students FTE (Full-Time Equivalent) - 6,265		
Projected Students FTE (Full-Time Equivalent)	x 8,391	x 9,533
	1,778,892	2,020,996
Present GSF (Gross Square Feet)	1,332,598	1,332,598
Anticipated needs in gross square feet	446,294	688,398

Average NASF (Net Assignable Square Feet)	188	188
Projected Students FTE (Full-Time Equivalent)	x 8,391	x 9,533
	1,577,508	1,792,204
Present NASF (Net Assignable Square Feet)	1,182,863	1,182,863
Anticipated needs in net assignable square feet	394,645	609,341

TOTAL OF ALL INSTITUTIONS

	1975-1976	1980-1981
Present Average GSF (Gross Square Feet)	179	179
Present Students FTE (Full-Time Equivalent) - 23,015		
Projected Students FTE (Full-Time Equivalent)	x 36,725	x 39,233
	6,573,775	7,022,707
Present GSF (Gross Square Feet)	4,136,324	4,136,324
Anticipated needs in gross square feet	2,437,451	2,886,383
Average NASF (Net Assignable Square Feet)	159	159
Projected Students FTE (Full-Time Equivalent)	x 36,725	x 39,233
	5,839,275	6,238,047
Present NASF (Net Assignable Square Feet)	3,666,671	3,666,671
Anticipated needs in net assignable square feet	2,172,604	2,571,376

Both the advantages and limitations of this procedure should be fairly obvious. Its prime advantage is in its grossness which allows extreme flexibility in specific future campus planning. It is equally apparent though, that while student projections are full-time equivalents, there is no distinction made between undergraduate and graduate student thus suggesting possible future inequities particularly when this problem is coupled with the knowledge that no determination has been made concerning the adequacy of the present space at any level. In addition to these broadly based reservations, a number of specific problems suggest themselves when one reflects on the specific character of each institution. Institution A, for instance, while viewed as being relatively stable in its future growth must determine whether its anticipated enrollment will be housed on campus, and also whether there will be any future shift from its current emphasis on the liberal arts to a more science oriented curriculum. Institution B, on the other hand, must determine because of the high degree of flexibility in its future curriculum change and growth, future space needs predicated on the basis of present physical space and reflecting current curricular structure will be adequate to meet its needs. Specifically, if there is a shift away from emphasis on academic programs to training in the technological fields, will the same amount of future space be required. Further, Institution C suggests more or at least different problems. Given its location, how it is to expand its facilities to almost twice its current size? Given its eventual graduate program expansion, do either the present average square feet figures or the full-time student equivalent figures accurately reveal its future space needs? Are the projections reliable given both the increased enrollments and the goals of reducing faculty-student ratio? Finally, Institution D, while facing many of

the same problems relative to the space needs of Institution C, does not have to cope with a limited availability of land. It must face the possibility of future program changes which could alter significantly specific kinds of future space needs.

The use of gross space figures allows a great deal of flexibility in planning. Their use, however, does not allow for the projection of specific kinds of space which might be different from present space. The next section of this report deals with the problems and procedures for projecting specific types of space such as classrooms, laboratories, offices and library space.

S E C T I O N I I

This section includes discussion and comment on the formula procedure used to project specific types of space, as categorized in the Higher Education Physical Facilities Inventory Procedures manual. It includes also, remarks about required input data, levels of utilization, and standards for allocation of those types of space for projection purposes.

SECTION II

As pointed out in the previous section the projection of space needs by gross factors has more than a few limitations. For this reason more refined projections seem appropriate. An institution may desire to specify in a detailed way the various types of space it will need in the future. The problem of defining those types must also be solved. In order to project future space needs, one must not only have an inventory of existing space but also be sure that the projections made are of the same space, as defined in that inventory. For instance, if one is projecting instructional space needs, defined as classroom, he must know whether his current inventory of that space includes the area needed to service that classroom and the space taken up by equipment. Again, to insure both equitable and comparable projections, care must be taken that space as reflected in the current inventory as well in future needs be clearly and unambiguously defined. Once this has been accomplished, difficult though it may be, it is then possible to determine with some degree of certainty the future types of space needed. It cannot be mentioned too often that the formulas ultimately derived, reflect, insofar as that is possible, the unique characteristics of an institution and its various kinds of programs. Since all future projections are and must be tentative, some middle position must be found between specifying space needs and maintaining a flexibility that will allow for both institutional and program creativity and continuous planning.[20] It is with these factors in mind that the following discussion

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[20]Edwin D. Etherington and Richard F. Vancil, "Systems and Simulations: New Technology Goes to Work on Decision-Making," College and University Business, Vol. XLVI (March, 1969), p. 60.

concerning formula for projections of specific types of space takes place. For purposes of continuity and for discussion the section is divided roughly into categories which reflect the various areas of space encompassed in higher educational institutions. While it is recognized that the individual reader may not necessarily agree with the stated definition or the criteria, these are submitted to provide a basis for discussing procedures.

Before beginning a discussion of specific types of space some additional general remarks are appropriate. Mention has been made of the need for inventory data and of the variety of constraints that must be considered in projections since in most cases they do not reflect any judgment concerning present adequacy or quality. Past decisions affecting space need have been made based on simple allocation; so much square feet of space required for each student. This procedure, while somewhat adequate for some types of space, does not attempt to cope with the level of utilization regarding other space. Also, it does not account for improvement in space use, increased demand for new situations or programs, or varieties of space needed from program to program.[21] While it is readily admitted that there are certain types of space for which it is inappropriate to consider utilization in determining allocation, there are certain types of space whose function make valid consideration of a level of use. In the more recent space projections, it has been found relevant to establish allocation for some types of space by including a study of level of utilization for those types where function makes it possible to consider use.

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[21]Middlebrook, p. 4.

The term utilization is applied most commonly to two specific types of space: classrooms and laboratories as they relate to instruction. The level of utilization for any room is most often stated as the answer to the following question. When a room is in use what percentage of the student stations available are filled? A reminder here is necessary, levels of utilization are usually determined for the period between 8:00 a.m. and 5:00 p.m. Utilization can and is affected by many variables within an institution not the least of which are diversity of programs, size of campus, and class scheduling. It may be important to refine utilization descriptions to reflect specific campus size or educational programs rather than for the entire instructional program of an institution. Details and exemplification of utilization will follow in the discussion of space as it relates to instructional space, particularly classrooms and laboratories.

With these preliminary remarks what follows is a discussion of specific types of space and methods of projecting future square feet requirements of those types. It is necessary to remind the reader that all or some of these space types could be aggregated for projection purposes. While this may in some cases be appropriate, there can be no question about the essential need for basic data about the types, prior to any potential aggregate projection. Finally, consistent with the recent Physical Facilities Inventory Utilization Study for Tennessee higher education, the types of space discussed are identical with those in the Higher Education Facilities Classification and Inventory Procedures Manual.[22]

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[22]Higher Education Facilities Classification and Inventory Procedures, ed. Nicholas A. Osso, fifth draft, National Center for Educational Statistics (Washington: U. S. Government Printing Office, 1967).

CLASSROOM

While it is possible to make some similar observations about both the projection of classroom and laboratory space, the character of each is unique enough to warrant individual consideration. The problem of projecting classroom space may involve many kinds of considerations. First, one may wish to distinguish between projecting the total number of stations needed and the number of classrooms by size needed to accommodate future students. The latter is relevant but is related too closely to particular educational programs to allow specific consideration here. The projection of specific classrooms involves the determination of two factors, the appropriate number of square feet per student station which reflects various types of classrooms desired such as lecture hall, regular classroom or seminar and the number of students each type should accommodate. Since the concern here is classroom space broadly defined, the factors involved are also broader in their application. As stated in the introduction to this section, the decisions about future classroom space involve, at least, the allocation of space. In other words, the number of student stations reflected in an appropriate average assignable square feet figure times the number of students to be accommodated will supply a figure for future planning. The following example, taken from one of the fictional institutions will both illustrate this approach and provide a basis for discussion about its appropriateness. The classroom space discussed here reflects also the service area; it is the type of space numbered 110 and 115 in the Procedures Manual.[23]

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[23] Higher Education Facilities Classification and Inventory Procedures, fifth draft.

INSTITUTION A

Present Net Assignable Square Feet of Classroom Space divided by	28,837
Present Number of Full-Time Equivalent Students	1,750
Net Assignable Square Feet per Full-Time Equivalent Student	16
Additional Students by 1975	250
250 X 16 (Net Assignable Square Feet per Student) =	
Additional Net Assignable Square Feet of Classroom Space by 1975-1976	4,000
Additional Students by 1980	750
750 X 16 (Net Assignable Square Feet per Student	12,000
Additional Net Assignable Square Feet of Classroom Space by 1980-1981	8,000

While it might be helpful to exemplify further the application of this formula with the other three fictional institutions, this one example will be adequate for the present purpose. The above method for estimating net assignable square feet was simply a matter of determining present and future enrollments and doing the required calculations. The restrictions on the above methodology are several. However, two restrictions are of more immediate concern. Is the assumption that the present average square feet per student figure reflects an adequate or more than adequate amount of space true? Put differently, does the present average in fact provide enough space for each student consistent with the functions of the space involved. In addition, this figure has not discriminated between kinds of classroom space needed, namely seminar, lecture, etc.; although there is a sense in which this discrimination is unnecessary. However, this does not reduce the necessity for answering the first question, namely, whether the average square foot per student figure

serves the present need. The second problem and one which has been of increasing concern in higher education is the inability of the above procedure to determine or reflect how well the present space is being used. The increased cost in construction and corresponding limited amounts of money available to higher education may suggest the need to determine on an equitable basis the level of utilization to be expected in classroom space. Determining levels of utilization is both a function of analysis and decision-making. The analysis of historical data relative to levels of utilization achieved is vital to maintaining institutional autonomy; at the same time decision-making about appropriate levels of utilization must consider the unique characteristics of the institution. Besides these restrictions the above procedure may not reflect the equipment space within the room (a problem more relevant with the present advances in technology).

Although it is difficult to select one method which will consider as many relevant variables as possible, there have been recent attempts to do this. The problem involves also the re-alignment of some present definitions. The first factor to be considered must be the student. The problem of definition and as well as allocation of space here causes a number of difficulties. The resolution of this factor must be the realization that classroom space and the use of classroom space must be established by hours in room rather than by number of students per se or their equivalents. Specifically, this means that more appropriate for the determination of classroom space needs is the number of weekly student contact hours (WSCH) rather than credit hours, which do not necessarily reflect hours-in-room. Briefly put then, the allocation of classroom space is related to square feet per weekly contact hour and only indirectly to student or credit hours. In addition to the

above considerations, the assignment of square feet as it relates to weekly student contact hours should reflect the type of classroom to be used. This suggests that for projection purposes a range be given from which the appropriate square feet per station figure can be selected based on the kind of classroom and type of program it serves. By implication, it is evident that kind of classroom is quantified by assigning a certain amount of square feet to each student, such as 10 square feet per student station if it is a lecture classroom or 15 square feet per station if it is a regular classroom. The intent here is to provide a quantified description of kinds of classroom which allows projections more specific in nature. At this point, then, it is possible to project space needed to accommodate X number of weekly student contact hours with X amount of space. By selecting the amount of square feet needed to accommodate one station, the institution is able to project the kind of classroom space needed for a particular academic program. Further, by using historical information about the number of weekly student contact hours in that kind of classroom, the institution is able to project weekly student contact hours as they relate to that specific kind of classroom, and thus, to project specific kinds of space.

Example:

If

245 present Weekly Student Contact Hours (WSCH) in lecture rooms

200 Net Assignable Square Feet (NASF) representing lecture room space

Then

.89 NASF per WSCH for lecture rooms

1975

.89 NASF per WSCH
140 projected WSCH

125 additional NASF of lecture space needed

1980

.89 NASF per WSCH
240 projected WSCH

214 additional NASF of lecture space needed

Although this method has the advantage of more accurately reflecting actual need in terms of specified contact hours and kind of space relevant to the aims of the institution, it still does not allow any evaluation of the present level of utilization. The translation of students into weekly student contact hours, a truer reflection of actual future needs when coupled with a provision for different average square feet per student station to allow for unique institutional characteristics, was felt to allow more valid figures for projection purposes. Finally, there remains the need to describe a formula which would, in addition to the above, account for a level of utilization. Utilization may be described as the percentage of stations filled when the room is in use. With the following procedure, it is possible for an institution to set standards of utilization based on the number of hours in a week a room is to be used and the percentage of stations to be used within those hours. In most cases for classrooms this has been set at 30 hour a week 60 percent of stations occupied.[24] Without attempting to further

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[24]See Appendix B, Classroom Space.

justify the setting of standards for utilization, it is now possible to use the fictional data provided to determine future space needs, relative to classrooms. It is possible to develop a formula which will provide a "space factor". This formula will include the level of utilization expected and the average square feet per station. This "space factor" when multiplied times anticipated weekly student contact hour will provide the user with the amount of classroom space needed.

Example:

If

30 hours per week room use
60 percent of stations filled when classroom used
16 square feet per seat average

Then

60 percent of 30 hours per week = 18 hours per week of use

$$\frac{\text{16 square feet per seat}}{\text{18 hours per week per seat}} = 0.888 \text{ sq. ft. per student contact hour}$$

Weekly Student Contact Hours (WSCH) X 0.888 = space needed

The immediate advantage to the use of this approach is that all elements in the formula may change. Thus by changing one factor it is possible to improve present space use or anticipate space needs in terms of specific educational programs. An institution is able to specify the kind of classroom space desired rather than simply the total amount of space required for students. By establishing ranges for all elements in the formula, it is possible, given accurate projections of weekly student contact hours by student level, i.e. Freshman-Sophomore, Junior-Senior, etc., to establish space requirements consistent with the unique characteristics of any particular education program. This is of considerable importance when one deals with various kinds of laboratory space. The appropriate ranges for classroom space might be specified in the following manner:

20 hours per week of room use (ranges)
25
30
35

60 percent of stations filled when room is used (ranges)
65
70
75
80

14 square feet per student station (average) (ranges)
16
18
20
22

$$\frac{\text{Average Square Feet per Seat}}{\text{Percent of stations filled X Hours per Week of Room Use}} = \text{Space Factor}$$

Space Factor X Projected WSCH by Student Level and Program = Classroom Space Need

The point of this lengthy explication is twofold. First, to provide a clear description of the methodology; and second, to demonstrate that within the constraints of the formula, it is possible to maintain a relatively high degree of flexibility. Finally, while it may be appropriate for any particular institution to specify in detail the various kinds of future space requirements, it may be unnecessary or misleading to use such detailed figures for system, state or nationwide projections.

Before continuing to a discussion of laboratory space, there are some additional comments that are necessary to any discussion of classroom space projections, particularly as they are related to Tennessee. If the contents of the above discussion are applied to the fictional institutions, one is better able to visualize their effect and the potential benefits and hazards to their use.

Example:

Given:

For all institutions

30 hours per week room use
60 percent of seats filled
16 square feet per student station allowing 1 square foot for service area
.888 space factor, rounded, .89

For each fictional institution

Present (WSCH) Weekly Student Contact Hours

÷

Present (FTE) Full-Time Equivalent Students =

(AWSCH) Average Weekly Student Contact Hours

1975 - Projected FTE Students X AWSCH = Projected WSCH

1980 - Projected FTE Students X AWSCH = Projected WSCH

Then

WSCH X Space Factor .89 = Space Need

Space Need minus Present Space Available = Additional "Actual" Space Need

Institution A

Present WSCH (Total) 25,667

÷

Present FTE Students - 1,750 = 14 AWSCH

1975 - Projected FTE Student 2,000 X 14 = 28,000 WSCH

1980 - Projected FTE Student 2,500 X 14 = 35,000 WSCH

	WSCH		Space Factor		Sq. Ft. of Space Need
1969	25,667	X	.89	=	22,844
1975	28,000	X	.89	=	24,920
1980	35,000	X	.89	=	31,150

Present Classroom and Classroom Service Area Available 28,837

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: none
1980 Additional "Actual" Space Need: 2,313

Institution B

Present WSCH (Total) 8,247

÷

Present FTE Students - 1,110 = 7 AWSCH

1975 - Projected FTE Student 1,750 X 7 = 12,250 WSCH

1980 - Projected FTE Student 2,200 X 7 = 15,400

	WSCH		Space Factor		Sq. Ft. of Space Need
1969	8,245	X	.89	=	7,038
1975	12,250	X	.89	=	10,902
1980	15,400	X	.89	=	13,706

Present Classroom and Classroom Service Area Available 7,575

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: 3,327
1980 Additional "Actual" Space Need: 6,131

Institution C

Present WSCH (Total) 155,360

÷

Present FTE Students - 13,900 = 11 AWSCH

1975 - Projected FTE Student 24,584 X 11 = 270,424

1980 - Projected FTE Student 25,000 X 11 = 275,000

	WSCH		Space Factor		Sq. Ft. of Space Need
1969	155,360	X	.89	=	138,270
1975	270,424	X	.89	=	240,677
1980	275,000	X	.89	=	244,750

Present Classroom and Classroom Service Area Available 254,977

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: none
1980 Additional "Actual" Space Need: none

Institution D

Present WSCH (Total) 78,499

÷

Present FTE Students - 6,265 = 12 AWSCH

1975 - Projected FTE Student 8,391 X 12 = 100,692

1980 - Projected FTE Student 9,533 X 12 = 114,396

	WSCH		Space Factor		Sq. Ft. of Space Need
1969	78,499	X	.89	=	69,864
1975	100,692	X	.89	=	89,616
1980	114,396	X	.89	=	101,812

Present Classroom and Classroom Service Area Available 84,786

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: 4,830
1980 Additional "Actual" Space Need: 17,026

All Institutions

Present WSCH (Total) 267,771

÷

Present FTE Students - 23,015 = 11 AWSCH

1975 - Projected FTE Student 36,725 X 11 = 403,975

1980 - Projected FTE Student 39,233 X 11 = 431,563

	WSCH		Space Factor		Sq. Ft. of Space Need
1969	267,771	X	.89	=	238,316
1975	403,975	X	.89	=	359,538
1980	431,563	X	.89	=	384,091

Present Classroom and Classroom Service Area Available 376,175

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: none
1980 Additional "Actual" Space Need: 7,916

Since much comment has been made prior to this example, there remain only a few important remarks to be made. First, this application assumes that it is both possible and adequate that an institution have 16 square feet per student station available, and that it is able to use a room 30 hours per week at 60 percent fill. Second, it presumes that all student stations at all student levels require 16 square feet of space. Third, the application of the formula to aggregate data, clearly demonstrates a potential inability of the formulas to recognize individual institutional needs. Fourth, the method of arriving at average weekly student contact hours assumes an even and consistent distribution of contact hours for all students. All of this is not to say that an institution cannot specify these above figures to adequately reflect square feet and/or weekly student contact hours as they relate to specific educational programs and space needs. It does, however, emphasize the need for well-thought educational planning relative to space needs. Further remarks about these problems will be considered in the discussion of laboratory space.

LABORATORY SPACE

While much of what has been said about the projection of classroom space is true for laboratory space, there are several factors unique to this specific type of space. In particular because of their equipment and purpose, class laboratories do not allow the flexibility in scheduling that general classrooms do. Also, their unique function or purpose will suggest larger and less uniform square feet per student station. However, both of these factors can be incorporated into the formula suggested for determining future classroom needs. Within these suggested restrictions, however, the number of student stations used when the room is in use is expected to be higher. Relating these above factors to the formula used for classroom space, the one large variable will be the number of square feet per student station, which is in turn, a reflection of the type of educational program designating that space. There is then a need to determine for institutional projections a square foot figure which reflects in detail the type of program to be served. On the other hand, it may be adequate for system or statewide agencies to use an average figure, 50 square feet, for student laboratory station size including service area rather than a more specific figure as it reflects a particular program.

It is generally agreed, as reflected in other institutional and state level standards, that the level of utilization for laboratory classrooms should be twenty hours a week with 80 percent of the student stations occupied.[25] Given this anticipated level of use, the deter-

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[25] See Appendix B, Laboratory Space.

mination of the space factor, which is required to project future space based on projected weekly student contact hours, will be based on the appropriate amount of square feet per student station. This is reflected in either the specific educational program to be served or a more gross figure for system or statewide projection purposes.[26]

Examples:

I - Institution C, Home Economics Program

If

20 hours a week
80 percent use
100 square feet per station

100 ÷ (20 X .80) = 6.25

6.25 square feet per WSCH in Home Economics

II - Institution C, All regularly scheduled laboratory space (Room Type 210, 215)

If

20 hours a week
80 percent use
39 square feet per station (current average for entire institution)

39 ÷ (20 X .80) = 2.44

2.44 square feet per weekly student contact hour

While it is obvious that the latter example may not adequately reflect the educational programs for individual institutions, for the determination of broad requirements, this method may be appropriate. In addition, since the square feet per student station used should be determined on the basis of past and present inventories of space

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[26] See Appendix B, Laboratory Space by Educational Programs.

by program, the figure has a greater potential for accurately determining future space needs. The use of the above method allows for variation of all its numerical values and this enables both individual institutions and statewide systems to cope with characteristics unique to them.

The following are projections for all the institutions using their present square feet allocation per student station but also applying an expected utilization level of 20 hours a week at 80 percent fill. The procedure here is generally identical to the one applied to classroom space.

Institution A

Given:

20 hours per week room use
80 percent of seats filled
20 square feet per student station, including service area
1.25 space factor

2,075-Present WSCH (Weekly Student Contact Hours)
1.9-Present Average WSCH per student
3,800-1975 - Projected WSCH
4,750-1980 - Projected WSCH

Then

	WSCH		Space Factor		Space Need
1969	2,075	X	1.25	=	2,594
1975	3,800	X	1.25	=	4,750
1980	4,750	X	1.25	=	5,937

Present Laboratory and Laboratory Service Area 8,439

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: none
1980 Additional "Actual" Space Need: none

Institution B

Given:

20 hours per week room use
80 percent of seats filled
37 square feet per student station, including service area
2.31 space factor

2,828-Present WSCH (Weekly Student Contact Hours)
2.57-Present Average WSCH per student
4,497-1975 - Projected WSCH
5,654-1980 - Projected WSCH

Then

	WSCH		Space Factor		Space Need
1969	2,828	X	2.31	=	6,533
1975	4,497	X	2.31	=	10,388
1980	5,654	X	2.31	=	13,061

Present Laboratory and Laboratory Service Area 12,668

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: none
1980 Additional "Actual" Space Need: 393

Institution C

Given:

20 hours per week room use
80 percent of seats filled
48 square feet per student station, including service area
3.00 space factor

24,156-Present WSCH (Weekly Student Contact Hours)
1.73-Present Average WSCH per student
42,530-1975 - Projected WSCH
43,250-1980 - Projected WSCH

Then

	WSCH		Space Factor		Space Need
1969	24,156	X	3.00	=	72,468
1975	42,530	X	3.00	=	127,590
1980	43,250	X	3.00	=	129,750

Present Laboratory and Laboratory Service Area 118,297

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: 9,293
1980 Additional "Actual" Space Need: 11,453

Institution D

Given:

20 hours per week room use
80 percent of seats filled
65 square feet per student station, including service area
4.06 space factor

17,544 Present WSCH (Weekly Student Contact Hours)
2.80 Present Average WSCH per student
23,495-1975 - Projected WSCH
26,692-1980 - Projected WSCH

Then

	WSCH		Space Factor		Space Need
1969	17,544	X	4.06	=	71,229
1975	23,495	X	4.06	=	95,390
1980	26,692	X	4.06	=	108,369

Present Laboratory and Laboratory Service Area 82,303

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: 13,087
1980 Additional "Actual" Space Need: 26,066

All Institutions

Given:

20 hours per week room use
80 percent of seats filled
49 square feet per student station, including service area
3.06 space factor

46,603-Present WSCH (Weekly Student Contact Hours)
2.02-Present Average WSCH per student
74,189-1975 - Projected WSCH
79,251-1980 - Projected WSCH

Then

	WSCH		Space Factor		Space Need
1969	46,603	X	3.06	=	142,605
1975	74,189	X	3.06	=	227,018
1980	79,251	X	3.06	=	242,508

Present Laboratory and Laboratory Service Area 221,707

1969 Additional "Actual" Space Need: none
1975 Additional "Actual" Space Need: 5,311
1980 Additional "Actual" Space Need: 20,800

The leveling effect which takes place when all institutions are combined suggest the inappropriateness of combining and averaging this data. Also, within institutions there is a like assumption concerning all the laboratory programs. This points to the advisability of determining needs by program rather than overall institution averages. Finally, the bases for these projections may not consider present adequacy of space.

The other types of space included in the category of laboratory facilities (Room Type, 200) may be projected on one of several bases. While those laboratory spaces, not regularly scheduled or used by only one individual, will lend themselves to solutions similar to those for some types of classroom space, the non-class laboratory type, poses a different problem. Current thinking in space planning has suggested the research demand factor for projection purposes.[27] This factor is similar to the space factor in that it is related to FTE research faculty and the amount of space appropriate to various research areas and/or programs. For an institution which maintains a substantial amount of research space and anticipates growth of its research programs, factors would have to be developed for its individual programs. On the other hand, it may be sufficient to project space need based on the present average assignable square feet per student of the balance of this category. Or put differently, special class laboratories and individual study laboratories plus the area servicing these divided by the present FTE students will provide an average NASF per student. Note the following examples using the fictional institutions.

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[27]Bareither and Schillinger, pp. 58-60.

Example:

Institution A

Balance of space assigned to Laboratory Facilities		7,807
Present Students - 1,750		
Average NASF per Student	4.4	
1975 Projected FTE Students 2,000 X 4.4 =	8,800	
1980 Projected FTE Students 2,500 X 4.4 =		11,000
1975 Additional Space Need		993
1980 Additional Space Need		3,193

Institution B

Balance of space assigned to Laboratory Facilities		4,187
Present Students - 1,100		
Average NASF per Student	3.8	
1975 Projected FTE Students 1,750 X 3.8 =	6,650	
1980 Projected FTE Students 2,200 X 3.8 =	8,360	
1975 Additional Space Need		2,463
1980 Additional Space Need		4,173

Institution C

Balance of space assigned to Laboratory Facilities		26,324
Present Students - 13,900		
Average NASF per Student	1.8	
1975 Projected FTE Students 24,584 X 1.8 =		44,252
1980 Projected FTE Students 25,000 X 1.8 =	45,000	
1975 Additional Space Need		17,701
1980 Additional Space Need		18,676

Institution D

Balance of space assigned to Laboratory Facilities		11,035
Present Students - 6,265		
Average NASF per Student	1.7	
1975 Projected FTE Students 8,391 X 1.7 =	14,265	
1980 Projected FTE Students 9,533 X 1.7 =	16,206	
1975 Additional Space Need		3,230
1980 Additional Space Need		5,171

All Institutions

Balance of space assigned to Laboratory Facilities		49,353
Present Students - 23,015		
Average NASF per Student	2.1	
1975 Projected FTE Students 36,725 X 2.1 =	77,122	
1980 Projected FTE Students 39,233 X 2.1 =	82,389	
1975 Additional Space Need		27,769
1980 Additional Space Need		33,036

The most obvious restrictions on the above procedure are the assumptions that the present average assignable square feet is adequately meeting space needs and that there will be no future purpose or objective changes which would dictate a change in that average. Both of these restrictions can be eliminated, at least on an institutional level, by determining adequacy and by a comparison with future programs as they might relate to present space. Thus making this a feasible procedure.

OFFICE SPACE

The determination of future space needs in institutions, is in most cases, with the exceptions of classroom and laboratory space, a matter of allocation without reference to amount of use. It remains, therefore, to consider the appropriate allocations of space and the variety of bases on which these allocations can be made. Needless to say, the bases for establishing the amount of space needed to accommodate equipment, people or function can have as its source either present levels of allocation or some other agreed upon standards.

It is possible then in determining future office space (Room Type, 300) needs of all types to simply determine the present average of office space per full-time staff member and compute future space requirements on the basis of anticipated full-time staff members. Again, this approach may be adequate for statewide planning but may not be appropriate in determining an individual institution's future needs. Also, it is conceivable that for determining future needs, a certain amount of square feet might contain within the amount designated for each staff member, an amount for the development of conference and reception room space and/or for immovable equipment such as shelving. Finally, it may be appropriate to develop ranges of square feet to allow for particular kinds of construction specifications or requirements. For instance, by establishing minimums and maximums of square feet per full-time staff member, it would be possible for an institution by lowering the amount of square feet to increase the quality and/or conditions of an office. Within these considerations the ranges determined would then allow greater

flexibility in decision making about both the amount and quality of office and related space. In fact, by using either ranges or a single allocation of square feet per full-time equivalent faculty and staff member, the individual department within an institution is able to specify within that figure the design of space most appropriate to its purpose and philosophy. Bareither in his book on university space planning suggests that for departments with more than twenty-five full-time equivalent faculty and staff members "135 square feet per FTE generates sufficient office space to provide... a private office of 120 square feet for the faculty, a larger office for the department head, conference rooms, reception areas, and file and work rooms for departmental offices."[28] Below, the twenty-five member figure it is necessary to add a net assignable square foot amount to allow for adequate conference room space.[29] It is interesting to look at the effect of the application of various procedures to office space.

Example:

Institution D

Present Office Facilities		84,697
Present FTE Staff and Faculty	440	
Average Net Assignable Square Feet per FTE	192	
1975 - FTE Staff	576	
(576 -440) X 192 = Additional Office Space		26,112
1980 - FTE Staff	659	
(659 -440) X 192 = Additional Office Space		42,048

[28] Bareither and Schillinger, p. 57.

[29] Ibid., p. 57.

This procedure obviously proceeds on the assumption that the present average will be the determinant for future projections. If, however, the projections for the entire institution are made using a standard of 135 square feet, the results indicate that some adjustments in present use may make office space and conference space available to additional staff without immediate addition of space. The category office facility includes office space, office service space, conference room and conference service space.

Example:

Institution A

Given:

135 square feet projection allocation
110 present FTE faculty and staff
130 projected 1975 FTE faculty and staff
166 projected 1980 FTE faculty and staff

Then

	FTE Faculty and Staff		Allocation		Space Need
1969	110	X	135	=	14,850
1975	130	X	135	=	17,550
1980	166	X	135	=	22,410

Present Office Facility Space Available	36,342
1969 Additional "Actual" Space Need	none
1975 Additional "Actual" Space Need	none
1980 Additional "Actual" Space Need	none

Institution B

Given:

135 square feet projection allocation
90 present FTE faculty and staff
141 projected 1975 FTE faculty and staff
184 projected 1980 FTE faculty and staff

Then

	FTE Faculty and Staff		Allocation		Space Need
1969	90	X	135	=	12,150
1975	141	X	135	=	19,035
1980	184	X	135	=	24,840

Present Office Facility Space Available	14,181
1969 Additional "Actual" Space Need	none
1975 Additional "Actual" Space Need	4,854
1980 Additional "Actual" Space Need	10,659

Institution C

Given:

135 square feet projection allocation
940 present FTE faculty and staff
1,643 projected 1975 FTE faculty and staff
1,690 projected 1980 FTE faculty and staff

Then

	FTE Faculty and Staff		Allocation		Space Need
1969	940	X	135	=	126,900
1975	1,643	X	135	=	221,805
1980	1,690	X	135	=	228,150

Present Office Facility Space Available	169,060
1969 Additional "Actual" Space Need	none
1975 Additional "Actual" Space Need	52,745
1980 Additional "Actual" Space Need	59,090

Institution D

Given:

135 square feet projection allocation
440 present FTE faculty and staff
576 projected 1975 FTE faculty and staff
659 projected 1980 FTE faculty and staff

Then

	FTE Faculty and Staff		Allocation		Space Need
1969	440	X	135	=	59,400
1975	576	X	135	=	77,760
1980	659	X	135	=	88,965

Present Office Facility Space Available	84,697
1969 Additional "Actual" Space Need	none
1975 Additional "Actual" Space Need	none
1980 Additional "Actual" Space Need	4,268

All Institutions

Given:

135 square feet projection allocation
1,580 present FTE faculty and staff
2,490 projected 1975 FTE faculty and staff
2,699 projected 1980 FTE faculty and staff

Then

	FTE Faculty and Staff		Allocation		Space Need
1969	1,580	X	135	=	213,300
1975	2,490	X	135	=	336,150
1980	2,699	X	135	=	364,365

Present Office Facility Space Available	304,280
1969 Additional "Actual" Space Need	none
1975 Additional "Actual" Space Need	31,870
1980 Additional "Actual" Space Need	60,085

One must exercise caution in assuming the validity of the above approach. It makes certain arbitrary assumptions about office and conference space. Also, it seems to imply a basis for allocating space to staff and faculty members, when, it must be remembered, this standard is established for projection purposes and not for decisions affecting the assignment of space for staff and faculty members. The implication that additional office facilities are not needed in certain institutions may be erroneous since any number of factors may be affecting present distribution of space.

LIBRARY SPACE

The determination of library space designated study facilities in the Procedures Manual usually involves three separate areas, stack space, reading space and processing and service area (Room Type, 400). Here again, present physical space inventory data as well as unambiguous definitions are essential. Determination of additional space must be made for each category of space within the library. There have been developed procedures for determining future stack space needs. It is possible to establish allocations of space for each of these areas, and thereby to establish standards for judgments about present use and future need. Since, there are no present inventory data on shelf or stack space, any projections for determining present level of allocation and the bases for projecting future needs is difficult. However, by determining the entire square feet of shelf space and the present number of volumes housed on those shelves it is possible to average the net assignable square feet per volume. If no determination is made about the capacity as opposed to the present use then any projection based on the above average would carry that condition forward. As noted in Appendix B, there are, however, standards for the allocation of stack space. If one establishes that .1 net assignable square feet per bound volume is to be the standard then, it is plain that present level of allocation may be measured against potential level and future stack space needs would be the square feet figure resulting from that comparison.[30] The category of reader space is usually allocated on the basis of thirty square feet per station for

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[30]See Appendix B, Library Space.

twenty-five percent of the student body by headcount. Although this may be an adequate standard for institutions primarily undergraduate in nature, more precise standards may need to be set to accommodate a large graduate level enrollment and/or special services provided by a library. Finally, the processing and service area can be allocated as either a percentage of the two above categories or on the basis of assignable square feet per full-time equivalent staff member. In the former this is usually twenty-five to thirty-five percent of the combined categories of stack and reader space. If it is to be a square feet allocation, the general procedure is to designate a given amount such as 400 square feet and then add to that a given amount of square feet per FTE staff member, which is usually 135. The following examples assume three categories: stack space, reader and study space, and processing and service space.

Example:

If space is allocated on the following basis

Stack Space - .1 square foot per equivalent bound volume
Reader and Study Space - 30 square feet per student station for twenty-five percent of FTE students
Processing and Service Space - 25 percent of stack and reader and study space

Institution A

Present Givens:

2,781 - Stack Space
8,560 - Reader and Study Space
3,422 - Processing and Service Space
1,750 - Present FTE Students
2,000 - 1975 Projected FTE Students
2,500 - 1980 Projected FTE Students

Present Total Space Available 14,763

Institution A (cont.)

Then:

1969

Stack Space will hold 27,810 equivalent volumes		
Study and Reader Space - FTE Students ÷ .25 X 30 =	13,110	
Processing and Service Space- .25 of stack space X reader space	2,835	
Total -	18,726	
"Actual" Additional Space Need		3,963

1975

Stack Space	2,781	
Study and Reader Space	15,000	
Processing and Service Space	4,445	
Total -	22,226	
"Actual" Additional Space Need		7,463

1980

Stack Space	2,781	
Study and Reader Space	18,750	
Processing and Service Space	5,382	
Total -	26,913	
"Actual" Additional Space Need		12,150

*Institution B

Present Givens:

0	Stack Space
4,380	Reader and Study Space
580	Processing and Service Space
1,100	Present FTE Students
1,750	1975 Projected FTE Students
2,200	1980 Projected FTE Students

Present Total Space Available 4,960

*Since this is a developing institution, before determination can be made about library space, a decision must be made about the number of volumes needed to serve the institution's members, goals and objectives. Therefore, no further computation is done.

Institution C

Present Givens:

35,247 - Stack Space
27,355 - Reader and Study Space
8,255 - Processing and Service Space
13,900 - Present FTE Students
24,584 - 1975 Projected FTE Students
25,000 - 1980 Projected FTE Students

Present Total Space Available 70,857

Then:

1969

Stack Space will hold 352,470 equivalent volumes
Study and Reader Space 104,250
Processing and Service Space 15,651

Total - 151,148

"Actual" Additional Space Need 80,291

1975

Stack Space 35,247
Study and Reader Space 184,380
Processing and Service Space 54,906

Total - 274,533

"Actual" Additional Space Need 203,676

1980

Stack Space 35,247
Study and Reader Space 187,500
Processing and Service Space 55,686

Total - 278,433

"Actual" Additional Space Need 207,576

Institution D

Present Givens:

11,463 - Stack Space
17,823 - Reader and Study Space
3,517 - Processing and Service Space
6,265 - Present FTE Students
8,391 - 1975 Projected FTE Students
9,533 - 1980 Projected FTE Students

Present Total Space Available 32,803

Then:

1969

Stack Space will hold 114,630 equivalent volumes
Study and Reader Space 46,980
Processing and Service Space 7,321

Total - 65,764

"Actual" Additional Space Need 32,961

1975

Stack Space will hold 114,630 equivalent volumes
Study and Reader Space 62,910
Processing and Service Space 18,593

Total - 92,966

"Actual" Additional Space Need 60,163

1980

Stack Space will hold 114,630 equivalent volumes
Study and Reader Space 71,490
Processing and Service Space 20,738

Total - 103,858

"Actual" Additional Space Need 71,055

*All Institutions

Present Givens:

49,491 - Stack Space
53,738 - Reader and Study Space
15,194 - Processing and Service Space
23,015 - Present FTE Students
36,725 - 1975 Projected FTE Students
39,233 - 1980 Projected FTE Students

Present Total Space Available 123,383

Then:

1969

Stack Space will hold 494, 910 equivalent volumes
Study and Reader Space 403,020
Processing and Service Space 25,807

Total - 478,318

"Actual" Additional Space Need 354,935

1975

Stack Space will hold 494,910 equivalent volumes
Study and Reader Space 275,430
Processing and Service Space 81,230

Total - 406,151

"Actual" Additional Space Need 282,768

1980

Stack Space will hold 494,910 equivalent volumes
Study and Reader Space 294,240
Processing and Service Space 85,932

Total - 429,663

"Actual" Additional Space Need 80,420

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*Exclusive of Institution B.

There are several comments that are appropriate concerning these examples of projected library space needs. The determination of stack space need is a function of the number of volumes necessary for institutional purposes. In the above examples, that space was carried forward unchanged. If the definitions of the givens in the example and definitions for the bases for allocation are the same then certain types of additional space are needed. Implicit in the preceding discussion has been the assumption that traditional functions of the library will in the main be unchanged. Therefore, if the library changes or extends significantly its functions, the above standards may need to be modified extensively to allow for those functional changes. Also, the above procedures have used standards based, for the most part, on the past allocations of space and in many instances does not include a means of determining the adequacy of that space as it relates to present function. As with other categories of space previously discussed, it is possible to determine the appropriate allocation of space. However, once this is accomplished, both the allocations and formulas should be re-assessed from year to year to determine their current applicability.

SPECIAL USE FACILITIES

Physical education facilities usually account for the bulk of space in this category which also includes such space as Armory, Demonstration and Audio-Visual and other space coded Room Type 500 in the Classification Manual. The procedures used to project space for this category may be based on a simple space allocation or based on percentage of space per student. It is again important to specify this space, since it may or may not include shower, locker and equipment rooms. Also, it is possible to allocate space for this area by weekly student contact hours as indicated in Appendix B.[31] Both Colorado and Florida use an allocation of ten assignable square feet per weekly student contact hour to determine physical education space. This includes equipment, shower, locker room but not spectator seating area. Whether one uses as a basis for projecting square feet needs weekly student contact hours, student headcount, credit hours, or a percent of the total institutional physical space must be determined on the basis of the individual institutions purposes and objectives. The following example projects this type of space on the basis of average net assignable square feet per FTE student. This assumes, of course, that the present amount of space is more or less adequate.

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[31]See Appendix B, Physical Education Space.

Institution A

Present Special Use Facility total square feet		42,640
÷ Present FTE Student 1,750 =		
Average Special Use NASF per FTE Student	24	
Projected 1975 FTE Student	2,000	
X 24 Average NASF =		48,000
1975 Additional Space Needs		5,360
Projected 1980 FTE Student	2,500	
X 24 Average NASF =		60,000
1980 Additional Space Needs		17,360

Institution B

Present Special Use Facility total square feet		720
÷ Present FTE Student 1,100 =		
Average Special Use NASF per FTE Student	.65	
Projected 1975 FTE Student	1,750	
X .65 Average NASF =		1,138
1975 Additional Space Needs		418
Projected 1980 FTE Student	2,200	
X .65 Average NASF =		1,430
1980 Additional Space Needs		710

Institution C

Present Special Use Facility total square feet		176,712
÷ Present FTE Student 13,900 =		
Average Special Use NASF per FTE Student	13	
Projected 1975 FTE Student	24,584	
X 13 Average NASF =		319,592
1975 Additional Space Needs		142,288
Projected 1980 FTE Student	25,000	
X 13 Average NASF =		325,000
1980 Additional Space Needs		148,288

Institution D

Present Special Use Facility total square feet		125,349
÷ Present FTE Student 6,265 =		
Average Special Use NASF per FTE Student	20	
Projected 1975 FTE Student	8,391	
X 20 Average NASF =		167,820
1975 Additional Space Needs		42,471

Institution D (cont.)

Projected 1980 FTE Student	9,533	
X 20 Average NASF =		190,660
1980 Additional Space Needs		65,311

All Institutions

Present Special Use Facility total square feet		345,421
÷ Present FTE Student 23,015 =		
Average Special Use NASF per FTE Student	15	
Projected 1975 FTE Student	36,725	
X 15 Average NASF =		550,875
1975 Additional Space Needs		205,454
Projected 1980 FTE Student	39,233	
X 15 Average NASF =		588,495
1980 Additional Space Needs		243,074

GENERAL USE FACILITIES

This category includes many areas such as Assembly, Exhibition, Food, Health, Lounge, Merchandising and Recreation, (Room Type, 600). Since historical data on these areas does not indicate that a proportionately large amount of space is allocated for these purposes, little has been done to determine a basis for the allocation of space. Typically, when projections of this type of space was needed it was based on a percentage of all other institutional space. If the average net assignable square feet per FTE students is used the results need careful analysis to determine their appropriateness as a basis for future projections.

Institution A

Present General Use Facilities total square feet		57,428
÷ Present FTE Students 1,750 =		
Average NASF per FTE Student	33	
Projected 1975 FTE Student	2,000	
X 33 Average NASF =		66,000
1975 Additional Space Needs		8,572
Projected 1980 FTE Student	2,500	
X 33 Average NASF =		82,500
1980 Additional Space Needs		25,072

Institution B

Present General Use Facilities total square feet		6,874
÷ Present FTE Students 1,100 =		
Average NASF per FTE Student	6	
Projected 1975 FTE Student	1,750	
X 6 Average NASF =		10,500
1975 Additional Space Needs		3,626
Projected 1980 FTE Student	2,200	
X 6 Average NASF =		13,200
1980 Additional Space Needs		6,326

Institution C

Present General Use Facilities total square feet		136,562
÷ Present FTE Students 13,900 =		
Average NASF per FTE Student	10	
Projected 1975 FTE Student	24,584	
X 10 Average NASF =		245,840
1975 Additional Space Needs		109,278
Projected 1980 FTE Student	25,000	
X 10 Average NASF =		250,000
1980 Additional Space Needs		113,438

Institution D

Present General Use Facilities total square feet		99,854
÷ Present FTE Students 6,265 =		
Average NASF per FTE Student	16	
Projected 1975 FTE Student	8,391	
X 16 Average NASF =		134,256
1975 Additional Space Needs		34,402
Projected 1980 FTE Student	9,533	
X 16 Average NASF =		152,528
1980 Additional Space Needs		52,674

All Institutions

Present General Use Facilities total square feet		300,718
÷ Present FTE Students 23,015 =		
Average NASF per FTE Student	13	
Projected 1975 FTE Student	36,725	
X 13 Average NASF =		477,425
1975 Additional Space Needs		176,707

All Institutions (cont.)

Projected 1980 FTE Student	39,233	
X 13 Average NASF =		510,029
1980 Additional Space Needs		209,311

SUPPORT OR AUXILIARY FACILITIES

As with General Use Facilities, Support or Auxiliary Facilities, data processing, shop, storage, central food, and central laundry, (Room Type, 700) may be determined as a percentage of the total for the other categories, NASF per 100 credit hours, NASF per FTE Student. The following example reflects the last of these approaches.

Institution A

Present Support or Auxiliary Facilities total square feet		5,350
÷ Present FTE Students 1,750 =		
Average NASF per FTE Student	3	
Projected 1975 FTE Student	2,000	2,000
X 3 Average NASF =		6,000
1975 Additional Space Needs		650
Projected 1980 FTE Student	2,500	
X 3 Average NASF =		7,500
1980 Additional Space Needs		2,150

Institution B

Present Support or Auxiliary Facilities total square feet		717
÷ Present FTE Students 1,100 =		
Average NASF per FTE Student	.65	
Projected 1975 FTE Student	1,750	
X .65 Average NASF =		1,137
1975 Additional Space Needs		420
Projected 1980 FTE Student	2,200	
X .65 Average NASF =		1,430
1980 Additional Space Needs		713

Institution C

Present Support or Auxiliary Facilities total square feet		12,229
÷ Present FTE Students 13,900 = Average NASF per FTE Student	.88	
Projected 1975 FTE Student	24,584	
X .88 Average NASF =		21,633
1975 Additional Space Needs		9,404
Projected 1980 FTE Student	25,000	
X .88 Average NASF =		22,000
1980 Additional Space Needs		9,771

Institution D

Present Support or Auxiliary Facilities total square feet		32,681
÷ Present FTE Students 6,265 = Average NASF per FTE Student	5	
Projected 1975 FTE Student	8,391	8,391
X 5 Average NASF =		41,955
1975 Additional Space Needs		9,274
Projected 1980 FTE Student	9,533	
X 5 Average NASF =		47,665
1980 Additional Space Needs		14,984

All Institutions

Present Support or Auxiliary Facilities total square feet		50,977
÷ Present FTE Students 23,015 = Average NASF per FTE Student	2	
Projected 1975 FTE Student	36,725	
X 2 Average NASF =		73,450
1975 Additional Space Needs		22,473
Projected 1980 FTE Student	39,233	
X 2 Average NASF =		78,466
1980 Additional Space Needs		27,489

RESIDENTIAL FACILITIES

The space needs in this category, (Room Type, 900) which involves dormitories, food service in residence halls, one-family dwelling and multi-family dwellings, are usually specifically determined on the basis of projected load for that facility. Beyond this, however, it is conceivable that the dormitory could include different functions and, therefore, the basis for projecting future space needs would have to be altered sufficiently to account for those changes. This would be particularly true if, for instance, an institution was considering a "living-learning" structure in its future growth plans. Given the present rather absolute basis for determining dormitory space needs, this study will not consider it further in this report except to emphasize the importance of student projections as they relate to the need for dormitory space.

NON-ASSIGNABLE FACILITIES

As with some other categories of space the non-assignable area, (Room Type, 000) which includes custodial, mechanical, circulation and construction, often is a function of the sum of the other assignable space within a building, an institution, or a total system.

Example:

	Non-Assignable Facilities	Total Net Assignable Sq. Ft.	Percentage
Institution A	110,382	487,600	2
Institution B	20,924	72,806	3
Institution C	424,023	1,923,402	2
Institution D	264,761	1,182,863	2
All Institutions	820,090	3,666,671	2

UN-ASSIGNED FACILITIES

This space includes inactive, alteration and/or conversion and unfinished designated Room Type, 080 in the Classification Manual. It also, in most instances, is represented as a percentage of the total assignable space available based on trends reflected in previous inventory. In other words, evidence from the past use of space suggest that a building, an institution and/or system can anticipate that a certain percentage will be contained in this category.

Example:

	Un-Assignable Facilities	Total Net Assignable Sq. Ft.	Percentage
Institution A	none	487,600	0
Institution B	0	72,806	0
Institution C	6,417	1,923,402	.3
Institution D	23,579	1,182,863	2
All Institutions	29,996	3,666,671	.8

The division of space into the above categories was based as stated earlier on the fifth draft of Higher Education Facilities Classification and Inventory Procedures Manual. This was felt necessary in light of the methodology used in the recent Tennessee Higher Education, Physical Facilities Inventory Utilization Study. Although there have been minor revisions in the classification and inventory procedures, it is possible to reconcile these changes for projection purposes. The next section of this report considers the present state of information as it relates to future space projections and also recommendations appropriate to any projection procedure consideration.

S E C T I O N I I I

This part of the report contains the recommendations concerning the implementation of physical facilities projection procedures. It also contains a brief summary of the contents of the previous sections.

SECTION III

RECOMMENDATION AND CONCLUSION

This final section contains the several recommendations that are, in this author's opinion, an outgrowth of the previous analysis. It is not expected that the reader will agree with all of the recommendations. In fact, as with the body of the report, the intent is to provide a starting point for the necessary discussion of procedures. The following recommendations then seem relevant.

1. Physical facilities planning must be a continuing process and there should be some structured process to insure continual review.
2. Institutions must continue to collect basic information about: faculty, staff, students, finance, programs, facilities and equipment working ultimately to a total information system.
3. Basic information now available such as the Physical Facilities Inventory Utilization study should be updated and maintained to insure current and comparable data.
4. The limited availability of information should not be reason for failing to establish standards and formulas for projection of physical facilities.
5. All appropriate persons in higher education at least must be made aware of, if not involved in, the determination of standards and formulas.
6. Because of their severe limitations, standards and formulas must be continually reviewed to insure their appropriateness and validity.

7. The need for the development of comparable and unambiguous definitions cannot be over-emphasized. Persons involved must agree to use the same definitions and also to agree on the manner for reporting exceptions.
8. Standards and formulas should be used to project physical facilities needs but should not be used to assign space to programs and/or persons.
9. Extreme care must be taken to insure that the standards and formulas do not inhibit creative curricular or space planning.
10. Formulas and standards should always be stated as working definitions and collected and made available simply as a working paper.
11. It should be recognized that the most appropriate formula and/or standards for a given institution may not be the most appropriate for projecting state needs.

A P P E N D I X A

REPORTS FROM OTHER STATES

APPENDIX A

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*Indicates that although these state agencies are involved in higher educational planning, there were no space projections presently planned or completed or the projections were not available for release.

A P P E N D I X B

SPACE STANDARDS OF VARIOUS STATES

CLASSROOM SPACE

ARKANSAS:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of stations occupied	.83

CALIFORNIA:

Recommended Utilization	Space Factor
34 hours per week with 66 percent of stations occupied	

COLORADO:

Recommended Utilization	Space Factor
30 hours per week with 67 percent of stations occupied	.75

DELAWARE:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of stations occupied	.83

FLORIDA:

Recommended Utilization		Space Factor
Board of Regents	- 33 hours per week with 60 percent of stations occupied	
Legislative Committee	- 36 hours per week with 60 percent of stations occupied	

NOTE: This list of standards now may not accurately reflect various changes made by states since the material from the states was gathered in the Fall, 1968 for this report. Also, the fact that not all states are listed does not mean that they are not using some standards but only that none were submitted for this report.

ILLINOIS:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of the stations occupied	.83

KENTUCKY:

Space Factor

Classrcom space projected on the following basis

No. of Sta.	20 Per Student	17
	30	15
	50	14
	125	10-12
	250	9-10

MISSOURI:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of stations occupied	.83

MONTANA:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of stations occupied	.83

OHIO:

Space Factor

Lecture Hall	Sq. Ft. Per Student
300 cap. +	10
Under 300	12
Classroom	
60-90	15
30-60	17
25	18
Seminar	
Conf. Room	25

OKLAHOMA:

Recommended Utilization	Space Factor
30 hours per week with 66 2/3 percent of stations occupied	.84

OREGON:

Recommended Utilization	Space Factor
30 hours per week with 60 percent of stations occupied	
33 hours as of January, 1969	

WISCONSIN:

Recommended Utilization	Space Factor
30 hours per week with 67 percent of stations occupied	.82
16.5 square feet per station	

LABORATORY SPACE

ARKANSAS:

	Recommended Utilization	Space Factor
	20 hours per week with 80 percent of stations occupied	

CALIFORNIA:

	Recommended Utilization	Space Factor
Lower Division Lab.	25 hours per week with 85 percent of stations occupied	based on 15 sq. ft. per student station
Upper Division Lab.	20 hours per week with 80 percent of stations occupied	

COLORADO:

	Recommended Utilization	Space Factor
Schools with Engineering	- 20 hours per week with 80 percent of stations occupied	3.59 (using 45 sq. ft. per student station, 27.5 service space)
Schools with substantial technical education	- 20 hours per week with 80 percent of stations occupied	4.4 (using 55 sq. ft. per student station, 17.5 service space)
Other Institutions	- 20 hours per week with 80 percent of stations occupied	2.94 (using 40 sq. ft. per student station, 17.5 service space)

DELAWARE:

Recommended Utilization	Space Factor
Graduate program including Agriculture	4.5
Undergraduate Liberal Arts	3.0
Technical Programs	4.5

FLORIDA:

	Recommended Utilization	Space Factor
Board of Regents		
Lower Division	20 hours per week with 75 percent of stations occupied	
Upper Division	15 hours per week with 75 percent of stations occupied	
Legislative Committee	24 hours per week with 80 percent of stations occupied	
	(57 net assignable sq. ft. per student station)	

ILLINOIS:

Recommended Utilization	Space Factor
20 hours per week with 80 percent of stations occupied	4.25

KENTUCKY:

	Space Factor
Undergraduate University with substantial enrollment in physical and life science	40-50 assignable sq. ft. per student station
Undergraduate Liberal Arts Junior and Community College	35-45 assignable sq. ft. per student station
University (with strong emphasis on graduate and engineering programs)	50-60 assignable sq. ft. per student station

MISSOURI:

Recommended Utilization	Space Factor
20 hours per week with 80 percent of stations occupied	3.75

MONTANA:

	*Space Factors	
	Lower Division	Upper Division
**200 Life Science		
210 Biological Science	2.81	4.38
220 Agricultural Science	4.38	7.19
230 Health Science	2.81	4.38
300 MCPE Sciences		
310 Math	1.88	1.88
320 Computer Science	7.50	11.52
330 Physical Science	3.75	5.62
340 Engineer Science	7.50	11.25
400 Behavioral Science		
410 Psychology	2.19	2.81
420 Social Science	2.19	2.81
500 Humanities		
510 Fine Arts	2.81	4.38
520 Letters	2.81	4.06
600 Professions		
610 Administrative Professions	2.81	2.81
620 Education	2.81	2.81
630 Environmental Design	2.81	4.38
640 Home Economics	2.81	2.81
650 Law	2.19	2.19
660 Social Work	2.19	2.19
670 Theology	2.19	2.19
700 Technical-Vocational		
705 Agriculture	4.38	7.19
710 Apparel	2.19	2.19
715 Business	2.19	2.19
720 Construction	7.19	7.19
725 Engineering and Industrial	7.19	7.19
730 Graphic Arts	2.19	4.38
735 Health	2.19	4.38
750 Public Service	2.19	2.19
760 Transportation		

*The above space factors are adjusted for the service space necessary to serve the classrooms and class laboratories.

**The number preceding the subject field is the code number for the field as specified in the Higher Education Facilities Classification and Inventory Procedures Manual.

OHIO:

	Space Factor
Lower Division	40 sq. ft. per student
Upper Division	100 sq. ft. per student
Graduate	150 sq. ft. per student
Drafting Room	35 sq. ft. per student
Fine Arts Studio	50 sq. ft. per student

OKLAHOMA:

	Recommended Utilization	Space Factor
	24 hours per week with 80 percent of stations occupied	
Life Science	75 assignable sq. ft. per student station	3.90
MCPE Science	144 assignable sq. ft. per student station	7.50
Behavioral Science	60 assignable sq. ft. per student station	3.12
Humanities	48 assignable sq. ft. per student station	2.50
Technical-Vocational:		
Agriculture	75 assignable sq. ft. per student station	
Apparel	75 assignable sq. ft. per student station	
Graphic Arts	75 assignable sq. ft. per student station	
Health	75 assignable sq. ft. per student station	
Business	38 assignable sq. ft. per student station	1.97
Construction	96 assignable sq. ft. per student station	5.00
Engineering	96 assignable sq. ft. per student station	
Industrial	96 assignable sq. ft. per student station	
Transportation	96 assignable sq. ft. per student station	
General	48 assignable sq. ft. per student station	

OREGON:

	Recommended Utilization	Space Factor
	20 hours per week with 80 percent of stations occupied	

WISCONSIN:

	Recommended Utilization	Space Factor
	24 hours per week with 80 percent of stations occupied	

OFFICE SPACE

	Assignable Sq. Ft. Per Faculty Station
ARKANSAS:	130 per full-time equivalent
CALIFORNIA:	110-130 assignable square feet per station
COLORADO:	168 assignable sq. ft. per full-time equivalent
DELAWARE:	140 assignable sq. ft. per person
FLORIDA:	145 sq. ft. per faculty
ILLINOIS:	135 sq. ft. per full-time staff or faculty member
KENTUCKY:	
Colleges and Universities	14 sq. ft. per full-time equivalent student
Universities with extensive graduate assistanships	20-40 sq. ft. per full-time equivalent student
Community Colleges	12 sq. ft. per full-time equivalent student

	Assignable Sq. Ft. Per Faculty Station
MISSOURI:	
	125 sq. ft. per full-time equivalent + 25 percent for related services
MONTANA:	
Instruction	
Faculty	160 sq. ft. per full-time equivalent
Graduate Teaching Assistant	60 sq. ft. per full-time equivalent
Public Service	
Professional	160 sq. ft. per full-time equivalent
Clerical	120 sq. ft. per full-time equivalent
General Administration	
President and Vice President	320 sq. ft. per full-time equivalent
Other Professional	250 sq. ft. per full-time equivalent
Clerical	120 sq. ft. per full-time equivalent
Physical Plant	
Professional	250 sq. ft. per full-time equivalent
Clerical	120 sq. ft. per full-time equivalent
OHIO:	
Office (Faculty)	120 sq. ft. per person
Chairman	150 sq. ft. per person
Clerical	100 sq. ft. per person
Research-Science, Engineering	300 sq. ft. per person
Teaching Assistant	100 sq. ft. per person
OKLAHOMA:	
	126 sq. ft. average office size arrived at by projecting student-faculty ratios
OREGON:	
	100 sq. ft. per full-time faculty member
WISCONSIN:	
	135 assignable sq. ft. per full-time equivalent

LIBRARY SPACE

ARKANSAS:

Stack Space	sq. ft. per volume	no. of volumes
	.10	first 150,000
	.09	next 150,000
	.08	next 300,000
	.07	additional volumes
Reader Space (study area)	6.25 sq. ft. per full-time student equivalent	
Library Service Area	25 percent of reader and stack space	

CALIFORNIA:

Stack Space	sq. ft. per volume	no. of volumes
	.10	first 150,000
	.09	next 150,000
	.08	next 300,000
	.07	next 400,000
	.05	second million
Reader Space (study area)	25 sq. ft. per reader station stations for 25 percent of 8-5 full-time equivalent	
Library Service Area		
Staff	100 sq. ft. per person	
Service Area	400 assignable sq. ft. + 140 assignable sq. ft. per full-time equivalent staff member	

COLORADO:

Stack Space	sq. ft. per volume 0.0833 assignable sq. ft. per volume to be housed
Reader Space	6.25 assignable sq. ft. per full-time equivalent at the university 5.00 assignable sq. ft. per full-time equivalent at other institutions

DELAWARE:

Stack Space	1 assignable sq. ft. per 10 volumes
Reader Space	20 assignable sq. ft. per reader for 25 percent of the students full-time equivalent
Service Space	140 sq. ft. per staff

FLORIDA:

Reader Space	30 assignable sq. ft. per reader station stations determined at 25 percent of full-time student

MISSOURI:

Stack Space	1 sq. ft. per 15 volumes to be housed
Reader Space	8.33 sq. ft. per full-time equivalent student/25 sq. ft. per station for 1/3 or full-time equivalent enrollment

MONTANA:

Stack Space	0.1 sq. ft. per volume
Reader Space	
Full-time equivalent lower division student	5 sq. ft.
Full-time equivalent upper division student	7 sq. ft.
Full-time equivalent graduate student	9 sq. ft.

OHIO:

Stack Space	0.07 assignable sq. ft. per volume
Reader Space	30 sq. ft. per station number of stations 1/3 of full-time equivalent students

OKLAHOMA:

Stack Space	.0667 assignable sq. ft. per volume
Reader Space	
Full-time equivalent lower division undergraduate student	5.00
Upper division undergraduate student	6.25
Full-time equivalent graduate student	7.50
Service Space	25 percent of the sum of reader and stack space

OREGON:

Stack Space	15 volumes per sq. ft. of floor area
Reader Space	25 sq. ft. per station stations determined at 25 percent of full-time student

WISCONSIN:

Stack Space	10 volumes per each sq. ft.
Reader Space	25 sq. ft. per station 20 percent of undergraduate student enrollment
	45 sq. ft. per station 25 percent of the graduate student enrollment
Office ans Support Space	135 sq. ft. per full-time equivalent library staff

PHYSICAL EDUCATION SPACE

ARKANSAS:	
(Does not include such things as dressing room, shower room or seating area	9 sq. ft. per weekly student clock hour
COLORADO:	
(Includes equipment room, shower room and locker room but not the seating area)	10 assignable sq. ft. per weekly student contact hours
FLORIDA:	
	10 assignable sq. ft. per weekly student contact hours
MISSOURI:	
Less 1,000 students	24 assignable sq. ft. per full-time equivalent students
1,000 to 3,000 students	16 assignable sq. ft. per full-time equivalent students
More than 3,000 students	14 assignable sq. ft. per full-time equivalent students

(This space factor includes diverse kinds of instructional space including the category: physical education.)

OKLAHOMA:	
Less 1,000 students	24 assignable sq. ft. per full-time equivalent students
1,000 to 3,000 students	16 assignable sq. ft. per full-time equivalent students
More than 3,000 students	14 assignable sq. ft. per full-time equivalent students

(This space factor includes diverse kinds of instructional space including the category: physical education.)

OTHER INSTRUCTIONAL SPACE

ARKANSAS:

The factor recommended is 40 percent of the amount of space used for classrooms, laboratories, physical education laboratories, and faculty offices.

COLORADO:

Examples of such space would be museums and galleries related to the instructional program and also auditoriums and theaters related to instruction.	5 assignable sq. ft. per full-time student equivalent

MISSOURI:

Less than 1,000 full-time equivalent	24 assignable sq. ft.
1,000 to 3,000	16 assignable sq. ft.
More than 3,000	14 assignable sq. ft.

OKLAHOMA:

Less than 1,000 full-time equivalent	24 assignable sq. ft.
1,000 to 3,000	16 assignable sq. ft.
More than 3,000	14 assignable sq. ft.

PHYSICAL PLANT SPACE

ARKANSAS:

4.7 percent of all educational and general, and auxiliary space need

COLORADO:

7.5 percent of all academic and general space excluding auxiliary enterprise

MISSOURI:

7.5 percent of all academic and general space excluding auxiliary enterprise space

RESIDENTIAL SPACE (DORMITORIES)

Although a few states supply factors to be used to compute future needs, they are not included in this study.

ORGANIZED RESEARCH SPACE

ARKANSAS:

1 sq. ft. per full-time equivalent undergraduate

65 sq. ft. per full-time equivalent masters level

820 sq. ft. per full-time equivalent doctoral level

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